

Slide 1 Admin/Procedural Controls



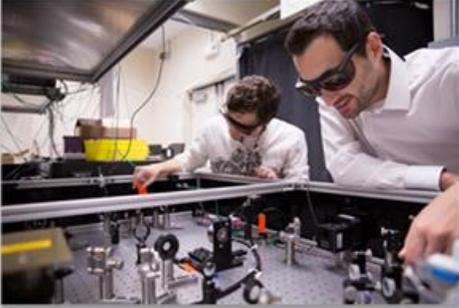
Administrative/Procedural Controls

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After completing this module, you will be able to:

- Identify safety documentation on hazards and controls
- Identify training requirements
- Recognize warning signs and labels
- Know procedures for safe beam alignment



After completing this module, you should be able to:

- Identify safety documentation that describes hazards and control measures
- Identify the training necessary to do your job
- Recognize warning signs and labels
- And know procedures to use for safe beam alignment



Safety Documentation

Talk to your supervisor to review safety documentation.

Safety documents must be easily accessible:

- Approved and current WPC Activity, where all hazards in the Laser Controlled Area are addressed.
- Training:
 - EHS 0302 *Laser Safety Training*, a web-based course or equivalent approved training
 - Triennial (i.e., every three years) refresher training: EHS 0302 *Laser Safety Training*
 - Documented on-the-job training
- Baseline laser eye examination (EHS 0288 *Laser Eye Exam*)
- Use of approved laser protective eyewear, when applicable
- Evaluation and approval of laser control measures by the LSO
- All lasers listed in the Laser Management System (LMS)



Work and hazard control documentation must be current and approved.

Talk to your supervisor to review the safety documentation for your area. At LBNL, you will review your Work Plan and Control activity. This typically includes: laser parameters and eyewear optical density requirements; and your training as well as these additional requirements as listed.



Site-specific On-the-Job training

- Hands-on alignment and operations training
- Operation modes (Laser Off, Laser Enclosed or Class 1, Laser On)
- Laser systems and safety controls
- Normal operation vs. Maintenance/Service
- Laser eyewear requirements
- Warning signs and labels
- **Safe alignment procedures**



Core Laser Safety "On the Job Training" Form
This form must be completed prior to allowing an individual to work alone

WPC Activity No: _____ Building: _____ Room(s): _____

OJT may be a prolonged process. The Activity Lead must ensure that all personnel, visitors, and students with access to the laser controlled area have a clear understanding of the controls associated with laser operation and that the relevant laser-safety procedures are diligently followed. The extent of OJT depends on the individual responsibilities and degree of hazard. It can apply to the entire experiment or elements of the research work (specific laser systems or experimental operations).

<p>At a minimum, the supervisor, activity lead, or designee must train/orientate staff on:</p> <ul style="list-style-type: none"> • Be familiar with WPC Activity and the hazards of the specific experimental work to be done • Proper alignment techniques and procedures for safe operation of the specific laser system, experiment, and associated optics • The location of potential hazardous beams and reflections • Engineering controls used to mitigate the hazards • The proper use of all required personal protective equipment (PPE) • How to communicate the hazard with other laser users 	<p>The OJT is achieved by:</p> <ul style="list-style-type: none"> • Mentoring the individual through instruction on the work process and safety steps • Demonstrating hands-on skills • Observing the individual while they perform the activity • Receiving feedback from the trainee
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Specific Tasks

Description of Laser System (e.g. pump laser, OPA, etc.)	Wavelength (e.g. 532nm, 532nm, 1500-2550nm)	Task (e.g. Analysis of samples only, starting of laser system, alignment, etc.)

The individuals listed below have demonstrated through OJT core laser safety skills for the specific tasks listed above.

Individual Performing OJT		Individual Receiving OJT		Date of OJT
Print Name	Signature	Print Name	Signature	

The OJT may be documented on this form or on equivalent form customized to fit the performed training. Key item: both parties must sign, trainer and trainee. Completed and signed forms should be uploaded to the WPC Activity Manager for electronic record keeping.

You're required to take this training every 3 years to maintain your laser safety qualification. In addition, you're required to take on-the-job training to learn the specifics of your set up for that laser.

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Site-specific training

- Hands-on alignment and operations training
- Operation modes (Laser Off, Laser Enclosed or Class 1, Laser On)
- Laser systems and safety controls
- Normal operation vs. Maintenance/Service
- Laser eyewear requirements
- Warning signs and labels
- **Safe alignment procedures**



Item #	Syllabus
1	Operation modes <ul style="list-style-type: none">i. Overview of different modesii. Procedure for setting or changing mode, how to enable laser, how to shut them down. New operators need to demonstrate changing modes while under supervision.iii. Review zero energy verification requirements when setting Laser Off or Class 1 modes.iv. Review requirements for unattended operation in Class 1 and Class 4.
2	Eyewear PPE: <ul style="list-style-type: none">i. Eyewear requirements for each operation modeii. Eyewear inspection and storage; how to clean and maintain eyeweariii. Proper fit and adjustment; Discard if damagediv. Review issues with dielectric-coated eyewear if used. Sensitivity to scratches + OD information not specified for incidence angles > 30 degrees.
3	Skin PPE: <ul style="list-style-type: none">• Availability of gloves and when to use them, especially if have UV beams• Recommend to enclose UV beams
4	UV Laser Operation <ul style="list-style-type: none">• Enclosures and barriers for UV laser beams• Skin PPE requirements (when to use gloves and face shields)
5	Entry and Exit procedures to the LCA <ul style="list-style-type: none">• Review verification requirements when entering/exiting the lab in Class I or Class 4.• Review requirements for securing lab entry door and any equipment doors.
6	Emergency Entry and Egress
7	Emergency Off
8	Fire extinguisher locations
9	Keys and key control: Master Key, Room Keys, Laser Keys, Keysafe
10	Overview of laser systems
11	Safety Shutters
12	Interlocks
13	Audible and Visual alarms
14	Warning signs and labels

Site-specific training will have an associated syllabus of items to cover. Some items will require hands-on training. The syllabus typically includes: reviewing different operation modes for the laboratory and how these are established, laser systems present in the lab and their associated controls and safety devices, distinguishing normal operation from maintenance and service, laser eyewear requirements, warning signs and labels, and safe alignment procedures

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Laser Worker Training

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Laser Labels

Display:

- Class of laser
- Wavelength
- Maximum power
- Pulse duration

Types:

- *Logo label* - class, maximum power and wavelength
- *Protective housing label* – interlocks
- *Aperture label* - beam exit area
- *Certification label* - if built to Federal Product Safety Standards

Inspect labels when you receive a new laser!



Commercial lasers come with a variety of labels that display important information about the system, such as the class of laser and its wavelength, maximum power, and pulse duration. Logo labels tell you the class of the laser, its wavelength, and its maximum power or pulse energy. Protective-housing labels are found on equipment beam housings and enclosures to tell you if they are interlocked or not. Aperture labels show where the beam exits a laser or laser equipment, and certification labels will be found on commercially manufactured lasers if they were built to Federal Product Safety Standards. When you receive a new commercial laser, be sure to inspect that the required labels are present and correct!

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Laser Worker Training

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Laser Area Warning Signs



The sign features a yellow background with a black border. At the top, a black triangle with a white exclamation mark is followed by the word "WARNING" in large, bold, black letters. Below this, on the left, is a yellow triangle with a black border containing a black sunburst symbol. To the right of the symbol, the text reads "Class 4 Laser Controlled Area" in bold, followed by "Avoid eye or skin exposure to direct or scattered radiation." Below this is a table with two columns: "Wavelengths" and "Eyewear OD Required". The table lists two rows: "532 nm" with "OD>6" and "1064nm" with "OD>6". At the bottom of the sign, it says "Laser Safety Officer: _____ Ext. _____".

<u>Wavelengths</u>	<u>Eyewear OD Required</u>
532 nm	OD>6
1064nm	OD>6

Laser Safety Officer: _____ Ext. _____

Radiation **above** Class 3R, >5x MPE

- Class 3B, most Class 4

Warning signs for Laser Controlled Areas are required at the entryway and indicate a potential personal safety hazard. These signs will give the laser wavelengths, optical density requirements, laser classification and a signal word: “Caution” indicates that laser radiation levels are low, and must be less than 5 times the MPE. Caution is used for Class 2, Class 2M and Class 3R lasers. “Warning” indicates that laser radiation levels are above the Class 3R limit, and is used for Class 3B and most Class 4 lasers. “Danger” indicates high laser radiation levels, and is only used for very high power, high pulse energy or high irradiance Class 4 lasers. “Notice” indicates a temporary situation or hazard, such as during alignment or service work. Specific wording and information listed on the signs will have to conform to requirements at the local site.

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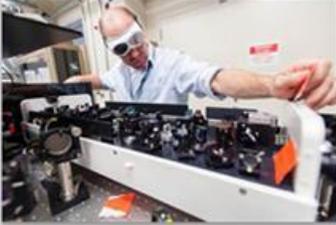
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Alignment Procedures

Key practices:

- Exclude unnecessary personnel
- Verify correct laser eyewear
- Reduce beam power or use a low power alignment laser
- Block beam when inserting/removing optics and when not needed
- Use enclosures, barriers and beam blocks
- Use sensor cards, cameras and viewers
- Check for and block stray beams
- Secure all optics to laser table
- Use irises
- Use extra caution with periscopes



Good alignment procedures are necessary for safe laser operations, and for procedures to work, they must be followed. Key practices for safe alignment include: exclude unnecessary personnel, verify that correct laser eyewear is used, attenuate laser beam or use a low power alignment laser, block the beam when inserting or removing optics, and when it is not needed; use enclosures, barriers and beam blocks; use sensor cards, cameras and viewers; check for and block stray beams; secure all optics to the laser table; use irises, and use extra caution with optics that generate out-of-plane beams, such as periscopes.

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Sensor Cards

- Used for locating beams during alignment
- For UV beams, many paper cards will fluoresce
- Beware of specular reflections from coated cards

Other types of sensor cards:

- Polaroid paper
- Burn paper



Sensor cards are a good way to locate beams during alignment. With a sensor card, the beam will produce a fluorescence or glow depending on the material used. For ultraviolet beams, paper will often fluoresce and can be used as a sensor card. Try to use cards with a matte finish that only produce diffuse reflections. Beware of specular reflections from sensor cards with a plastic coating. Polaroid paper and burn paper can also be used as sensor cards.

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Viewers

- Beam alignment
- Stray beams



Viewers enable you to see beams during alignment procedures. They can also be used to locate stray beams. When viewers are used during Class 3B or Class 4 laser operation, protective eyewear is also required.

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Cameras:

- Hands-free alignment tool
- Enhances safety

Uses:

- Precision alignment and co-aligning two beams
- Beam profile measurements/optimization
- Viewing hard-to-access areas

Remote viewing:

- Enables remote laser operation
- When used together with motorized optics, enables more engineering controls (barriers or enclosures)



Cameras can provide a hands-free alignment tool, and can have better sensitivity than fluorescent cards or viewers depending on the wavelength. You can view a beam interaction with a target more safely from a video monitor than by standing over the laser beam with a sensor card. Cameras can be used for: Precision alignment; Co-aligning two beams; Beam profile measurement and optimization, and Viewing hard-to-access areas. Cameras and monitors allow remote viewing by providing diagnostics for remote laser operation. Cameras and monitors are also often used in association with motorized optics; this allows you to install more barriers and enclosures for beam paths to improve the engineering controls. Remote viewing needs to be considered for Class 3B and Class 4 laser operation, especially for Class 4 lasers that require a DANGER area posting sign.

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(Drag and Drop exercise)

Laser Worker Training

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Alignment Exercise

Which of the following do you do during preparation prior to alignment, during alignment, and after alignment?
With your mouse, drag each box to the appropriate area. If the boxes snap back, try again.

Check for and block stray beams	Remove or cover jewelry, watches, ID badges	Replace enclosures, covers, beam blocks
Exclude unnecessary personnel	Verify correct laser eyewear for all personnel	View beams with sensor cards, viewers or cameras
Reduce beam power or use low power alignment laser	Have all equipment and materials available	Block beams when inserting or removing optics

Alignment Preparation	Alignment	After Alignment

Speaker icon SUBMIT

Let's do an Alignment Exercise. Which of the listed actions do you do during preparation prior to alignment, during alignment, and after alignment? Match each action to its corresponding alignment phase below.

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(Drag and Drop exercise)

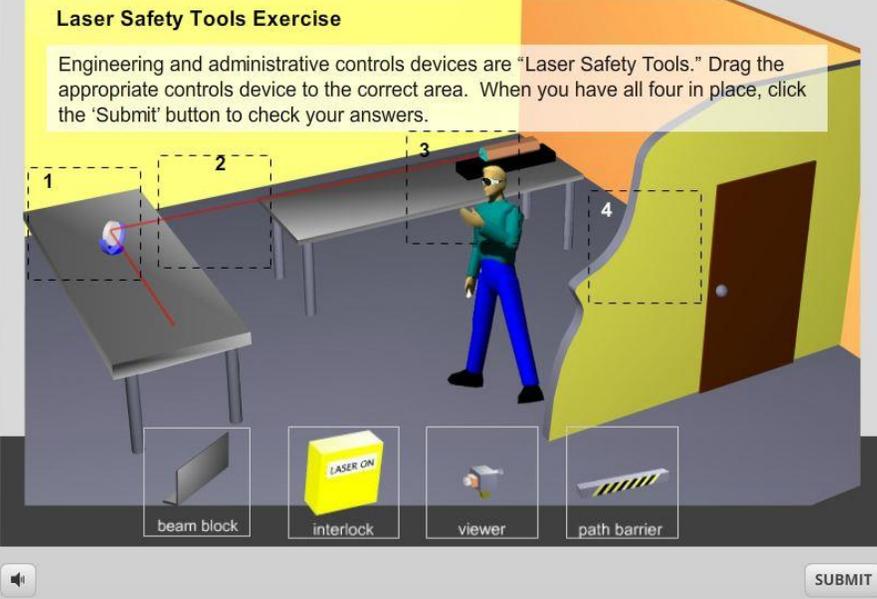
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Laser Safety Tools Exercise

Engineering and administrative controls devices are “Laser Safety Tools.” Drag the appropriate controls device to the correct area. When you have all four in place, click the ‘Submit’ button to check your answers.



beam block interlock viewer path barrier

SUBMIT

In this module and the previous one, you learned about a number of devices that can be used for engineering and administrative controls. We like to call these devices, “Laser Safety Tools.” For this exercise, match the controls devices to the correct areas. When you are done, click the “Submit” button to check your answers.